



Signal survival probability for Dalitz rejection in PHENIX

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- Simulation data
- Signal survival rate for Dalitz rejection



Simulation Data

- 1 These particles were generated using Exodus (made by R. Averbeck)

⚡ P, K, charged π , π^0 , η , η'

$P_t < 10 \text{ GeV}/c$ with power law distribution.

$|\text{Rapidity}| < 1.0$.

Multiplicities of each particles were determined by $dN_{\text{charge}}/dy(y=0)$ as input parameter.

⚡ Vector mesons (ω , ρ , ϕ , J/ψ , Y)

Kinematics was same as other particle.

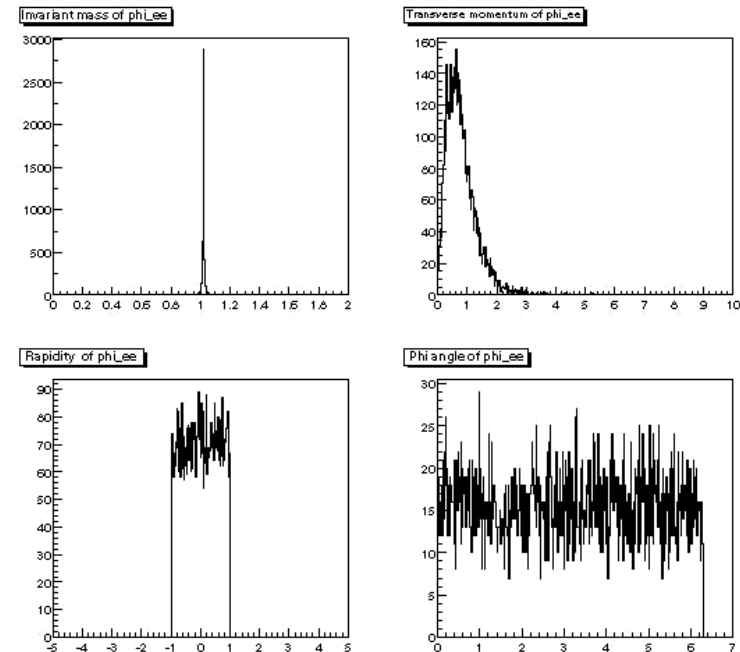
Generated one meson in each event.

Simulation Data (2)

- 1 Particle decays were also simulated.
 - ⌄ Dalitz decays of π^0 , η , η'
 - ⌄ Vector mesons (ω , ρ , ϕ , J/ψ , Y) decays
- 1 Output format is OSCAR format as PISA input format.
- 1 Several kind of $dN_{\text{charge}}/dy(y=0)$ data were generated.

$dN/dy = 10, 100, 300, 650$

Each data file contains
10000 events.





Dalitz rejection using invariant mass

- 1 Dalitz rejection was applied for simulation data and the signal survival rate was calculated.
- 1 Dalitz rejection scheme
 - 1 To determine a electron track is rejected or not,
 - ⌘ Invariant mass is calculated with all combination of the electron track and opposite sign electron.
 - ⌘ Opposite sign electron means miss identified pion and electrons from Dalitz decay. (γ conversion is not yet considered.)
 - ⌘ If one of these invariant mass has less than cut value, this track is rejected.

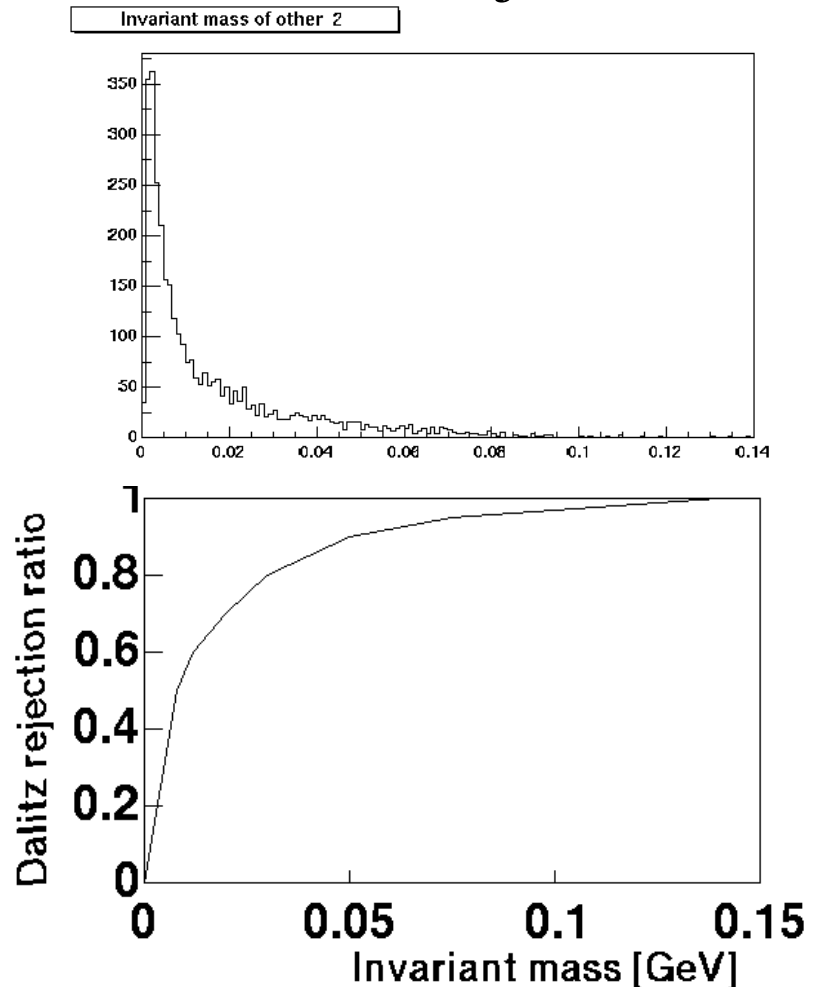


Assumptions for the calculation

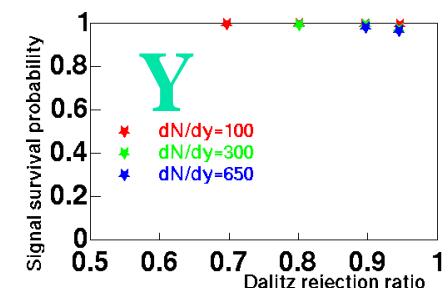
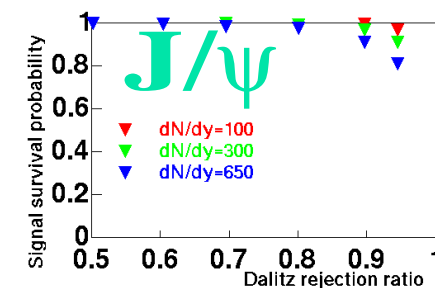
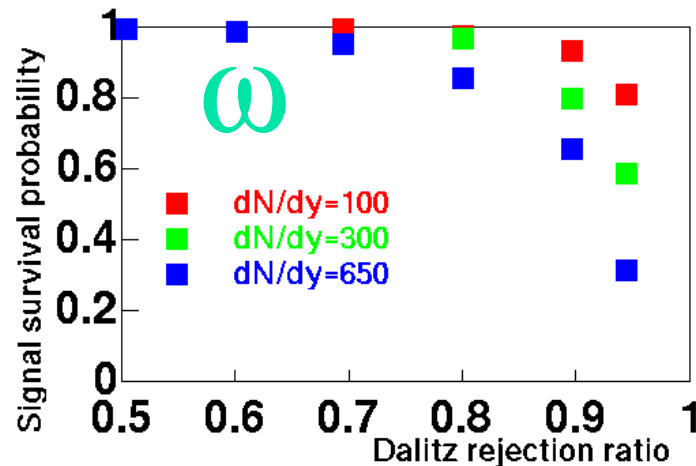
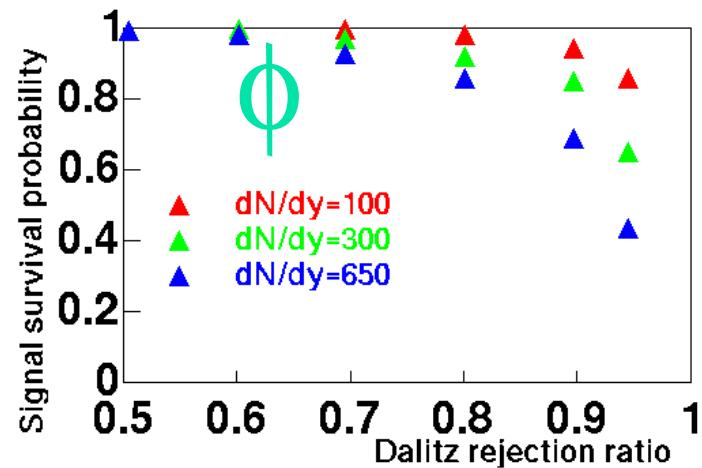
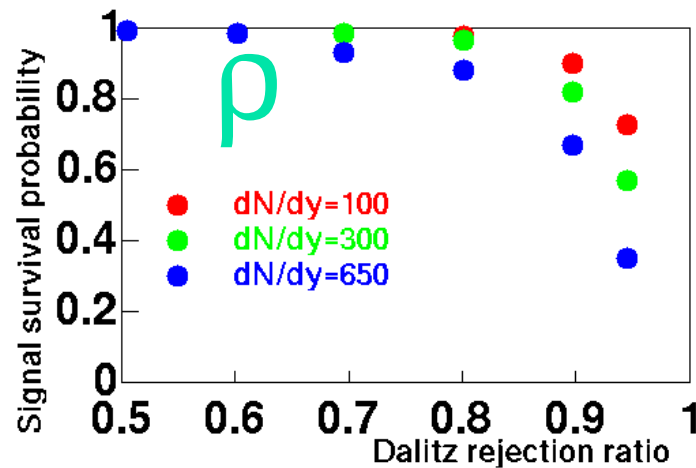
- 1 Both electron and positron from vector meson decays going to the PHENIX acceptance ($P_t > 200 \text{ MeV}/c$, $|\eta| < 0.33$ and $2 * (|\phi| < 90 \text{ degree})$).
- 1 The rejection factor for pion.
 - 1 In the PHENIX acceptance, rejection factor is 200.
 - 1 Out of the PHENIX acceptance, rejection factor is 100, for pions which has the momentum below $200 \text{ MeV}/c$.
 - 1 Out of the PHENIX acceptance, for pions which has the momentum above $200 \text{ MeV}/c$, we assumed no rejection.
- 1 Momentum of electron is required above $50 \text{ MeV}/c$. Perfect (100%) efficiency for electron identification and tracking is assumed.

Signal survival probability

- 1 Signal survival rates for several kind of Dalitz rejection ratio were calculated.
- 1 Dalitz rejection ratio were calculated as a fraction of Dalitz rejected events on the invariant mass histogram.
- 1 It was depends on mass cut parameter.
- 1 Calculations were done for Dalitz rejection ratio of 50%, 60%, 70%, 80%, 90%, 95%, and 100%.



Results



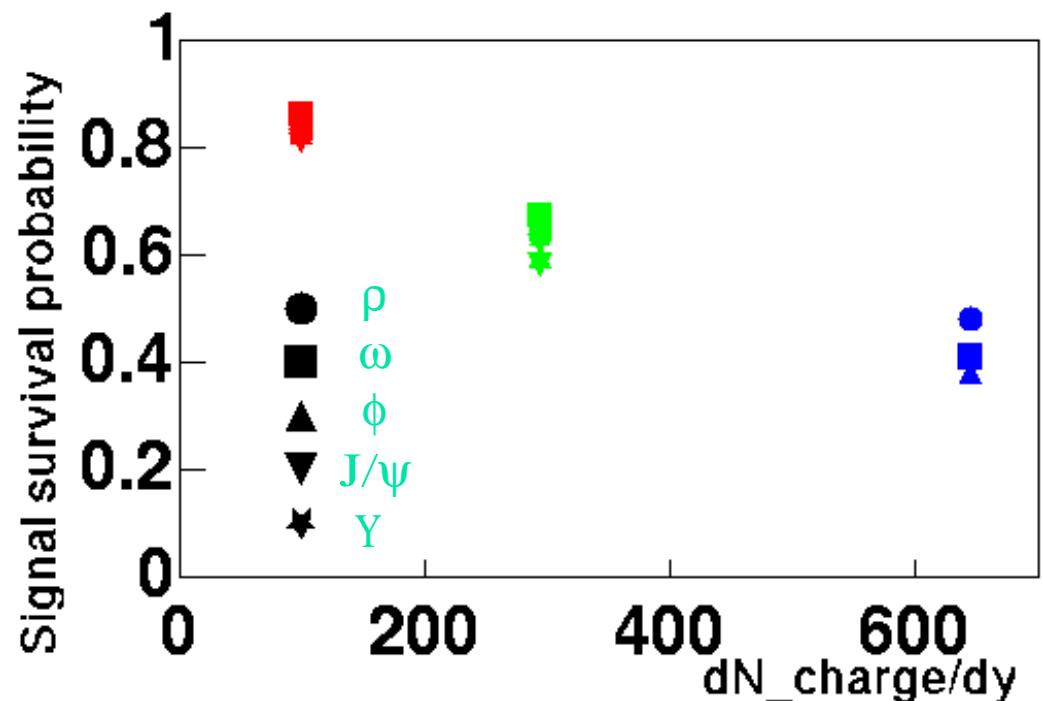
Survival probability of ϕ is 70% for $dN/dy = 650$, when we keep 90% Dalitz rejection ratio.

Dalitz rejection using opening angle

1 Signal survival rates for opening angle cut.

1 Assumption is the same as invariant mass cut.

1 Opening angle cut parameter is 200 m radian, which corresponding to 90% rejection for Dalitz pair. (PHENIX technical note 391)



For opening angle cut, we have to change assumptions for calculation. We need more discussion and careful calculation.



Summary and plan

- 1 Simulation data was generated for several kind of dN/dy using EXODUS.
- 1 Signal survival probabilities were calculated for several kinds of mass cut parameter and vector meson.
- 1 Survival probability of ϕ is 70% for $dN/dy = 650$, when we keep 90% Dalitz rejection ratio.
- 1 We have to apply
 - 1 Realistic pion miss identified efficiency.
 - 1 Realistic tracking efficiency and electron efficiency.
 - 1 Realistic Dalitz rejection scheme and dalitz rejection factor.
 - 1 Momentum and opening angle resolution
 - 1 Gamma conversion